Boreal 2050: Cumulative Stressors and the Boreal Forest

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Boreal Zone
**Overview**

**Phase 1: Scenario Analysis**
- examine *drivers of change* – influential forces with highly uncertain futures
- create future scenarios written as historical accounts 35 years from now

**Phase 2: Risk Management Analysis**
- use ISO standards to systematically assess the risks of ecosystem damage (based on scenarios/Phase 1)
- analyze the current policies to determine necessary ‘course corrections’
Scenario Analysis

What could happen if?...

Purpose:
- Enhance understanding
- Surface hidden assumptions and risks
- Provide context for evaluating the consequences of decisions
Scenario Analysis: a structured process

Identify Driving Forces

Define Critical Uncertainties

Describe Major Characteristics

Develop Logical Paths

Tool to assess whether current governance structures and policies/practices will lead us to a desirable Boreal Zone future

Scenario Analysis: a structured process

- Identify Driving Forces
- Define Critical Uncertainties
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Workshop 1
Montreal, QB
June 2016

Scenario Analysis

Drivers of change:

1) Demand for Provisioning Ecosystem Services (PrES)
2) Demand for Non-provisioning Ecosystem Services (NPrES)
3) Atmospheric Change (climate and pollutants) (AC)
4) Governance and Geopolitics (GG)
5) Industry and Innovation (II)
6) Demographics and Societal Values (DSV)
Identifying Drivers of Change

Drivers Synthesis:

Solicited graduate students (17) from across Canada under the mentorship from senior faculty (11) and government scientists at Natural Resources Canada (2) to prepare synthesis papers on drivers:

University of British Columbia
University of Alberta
Lakehead University
Western University
University of Guelph
University of Toronto

McGill University
University of New Brunswick
Dalhousie University
Alberta Innovates
Eco Risk Management
For each Driver:

- **Description** – current status
- **Looking back** – past changes in driver
- **Interactions** – what are the influences of drivers on each other?
- **Looking forward** – based on the interactions, 3 plausible but divergent scenarios (utopian, dystopian and status quo)
- **Conclusions** – implications for the future of the Boreal
Scenario Analysis: a structured process

- Identify Driving Forces
- Define Critical Uncertainties
- Describe Major Characteristics
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Workshop 1
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June 2016

Workshop 2
Montreal, QB
Nov 2016
What are the Axes of a Scenario Analysis?

Two HIGHLY INFLUENTIAL and HIGHLY UNCERTAIN forces that generate divergent futures.
How do you define the axes for the scenario analysis?

Selected Drivers

1. Geopolitics & Governance
2. Demographics & Societal Values
3. Industry and Innovation
4. Atmospheric Change
5. Demand for Provisioning Ecosystem Services
6. Demand for Non-provisioning ecosystem services

Apply a systematic approach to:

1. Rank the drivers
2. Identify drivers/forces with highest importance and highest uncertainty
3. Describe extremes of each axis

Scenario A
Scenario B
Scenario C
Scenario D

tell future histories: where are we in 2050, and how did we get here?
Future histories of the Great Lakes Futures Project

Axis 1: Human capacity for change
Axis 2: Balance environment and economy

Out of Control (-, -):
Failed to adapt and suffered the consequences; out of balance with no capacity to recover

Living on the Edge (-, +):
Converted challenges into profitable opportunities; in balance, but mostly opportunistic

Trying Hard to Adapt to a Chaotic World (+, -):
Complex challenges overwhelmed our best intentions; good governance, but overwhelmed by externalities

Thriving and Prosperous (+, +):
Rallied to confront collective challenges; sustainable balance through enlightened governance

Original artwork by Andrea Guzzetta
How do we achieve a course correction?

Risk Management Framework (31000)

Developed to avoid engineering failures ... adapted here to avoid ecosystem failures.


Gulf of Mexico dead zone. Image credit: NOAA.
Systematically assess gaps in policy and practice...

...science is not effectively mobilized for consultation purposes in policy formation

...people are not connecting to the messages that require them to change their behavior

Step 1. Establish the risk management context

Step 2. Risk Identification

Step 3. Risk Analysis

Step 4. Risk Evaluation

Step 5. Risk Treatment

...policy neglects to ask the appropriate questions to science in order to effectively improve legislation
ISO for Risk Management
ISO 31010: Bowtie Analysis

Step 1. Risk Management Context
What are the risks, who is responsible for managing them, and what are we trying to achieve?
Step 2. Risk Identification

Where do the vulnerabilities lay that may result in failure to meet the policy objective?

Shift focus from cumulative *impacts* to cumulative *pressures* and their *effects*.
ISO for Risk Management
ISO 31010: Bowtie Analysis

Step 3. Risk Analysis
What is the probability of failing to meet the policy objective - what is the “likelihood” and “magnitude” of the risk event that exist despite the system of management measures?

System of management measures (EU, 2008)

| Hard controls | AVOID                  | Where and when is the human activity allowed to occur? |
|               | PREVENT                | What is the amount of human activity permitted?       |
|               | MITIGATE               | What is the degree of impact?                        |
| Soft controls | ENABLE                 | What is the allocation and coordination of authority? |
|               | FACILITATE             | How can we make the public care that we can meet the policy objectives? |
|               | TRACK                  | What is the target, and how can we track compliance/conformity to reach the target? |
Step 3. Risk Analysis
What is the probability of failing to meet the policy objective - what is the “likelihood” and “magnitude” of the risk event that exist despite the system of management measures?
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Step 4. Risk Evaluation
“So what?” - what are the ecosystem services that may be reduced or lost if the significant ecosystem functions are not safeguarded.

Policy

Objective

Drivers

Effect

Impacts

Prevention controls

Mitigation controls

Escalation Factors

Low Tolerance Risk Matrix
Moderate Tolerance Risk Matrix
High Tolerance Risk Matrix

How do you define the axes for the scenario analysis?

Step 5. Risk Treatment
How do we change the management system to reduce the risk event?

ISO 31010: Bowtie Analysis

Drivers
Pressure
Pressure
Pressure

Policy
Objective

Effect

Impacts

Prevention controls
Mitigation controls
Escalation Factors

Moderate Tolerance
Risk Matrix

Magnitude

Likelihood

Adaptive management is iterative...

ISO for Risk Management
ISO 31010: Bowtie Analysis

Step 1-5 → Repeat
# Project Timeline

| J  | J  | A  | S  | O  | N  | D  | J  | F  | M  | A  | M  | J  | A  | S  | O  | N  | D  |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Workshop 1 | 1 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Driver selection | * |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Driver literature-data analysis |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Driver write up |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Workshop 2 | 2 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Driver presentation | * |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Forces & futures selection |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Forces & futures write up |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Where are our current policies leading us? |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Risks identification | * |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Management system data compilation & analysis |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Workshop 3 | 3 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Risk analysis presentation |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Risk analysis write up |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Workshop 4 | 4 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| AOM |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

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**Nov 10-12**  
McGill University  
Montreal, QB  
29 Attendees
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Questions?